Creation and Application of TiBTA Nanoporous Metallic Foams (NMFs) in Reduced Gravity

Problem Statement

Nanoporous metal foams (NMFs) created in a microgravity environment have been of superior quality when compared to NMFs created under normal terrestrial conditions.

Given the high, multi-industry demand for materials exhibiting properties of high strength and low weight, research in titanium-based NMFs is highly relevant to NASA. Other applications: solar cells, biomedicine – osseointegration.

Several studies have demonstrated the superior porosity distribution of titanium-based NMFs created under microgravity conditions. Beyond the aforementioned data, however, little is known about the manner in which titanium-based NMFs created in microgravity conditions differ from the foams created in terrestrial conditions.

Technology Development Team

- **Principal Investigator:**
  Kristen OMara-Scotti,
  Northwestern University
  KristenOmara2014@u.northwestern.edu
- **Organization (funding support):**
  Northwestern University,
  339 E. Chicago Ave.,
  Chicago, IL 60611
  (312) 503-3009
  Contact: Peter Kaye,
  Assistant Dean of Undergraduate and Professional Programs

Proposed Flight Experiment

Experiment Readiness:

- The experiment will be ready for flight at the beginning of the first quarter of 2013.

Test Vehicles:

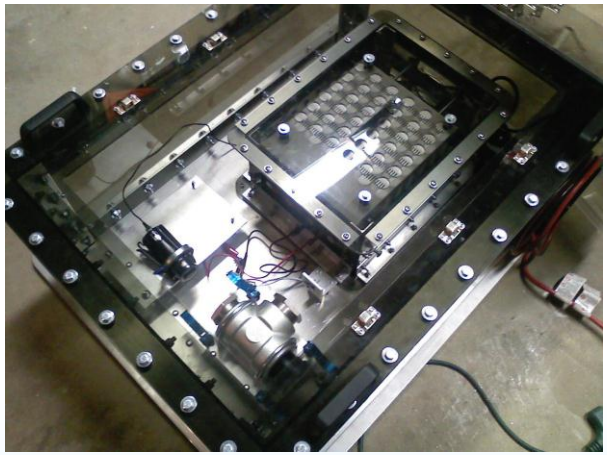
- Parabolic Flight

Test Environment:

- The apparatus has previously flown on a parabolic flight as part of NASA's Reduced Gravity Student Flight Program .

Test Apparatus Description:

- The apparatus consists of a polycarbonate box which houses a power supply, camera and sample chamber. The sample chamber contains the reaction and resulting NMF.



Technology Maturation

- The research is currently classified as a TRL level 7, in that the research meets the specifications of level 7 in terms of hardware, software and exit criterion.
- The apparatus is currently ready for flight.

Objective of Proposed Experiment

Objective: To create superior quality, titanium-based nanoporous metallic foams in a microgravity environment and elucidate the differences between that and ground-based samples. Model solar cells and sandwich panel cores incorporating the foam will also be prototyped to serve as a precursor mission for possible follow up on the International Space Station.

Hypothesis: Titanium-based NMFs created in microgravity conditions will exhibit enhancement in high porosity with a uniform pore distribution. Such enhancement will improve efficiency of solar cells and sandwich panel cores.

Applicable Technology Areas: *Nano Lightweight Materials and Structures 10.1.1*, *Nano Energy Generation 10.2.1*, *Solar Power and Generation 3.1.3* (Level 3)